

Sub-Saharan African Eurobond yields: What really matters beyond global factors?☆

Christian Senga^{a,*}, Danny Cassimon^a, Dennis Essers^{a,b}

^a *Institute of Development Policy (IOB), University of Antwerp, Belgium*

^b *Economics and Research Department, National Bank of Belgium, Belgium*

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Abstract

This study explores the drivers of secondary market yields of Sub-Saharan African (SSA) sovereign Eurobonds from 2008 to mid-2017. Our results indicate that, beyond global ‘push’ factors, country-specific ‘pull’ factors such as inflation and GDP growth matter too for SSA Eurobond performance. A panel error-correction analysis suggests large heterogeneity in the short-term influence of our global and country variables across countries. We find no significant effect of bond-specific factors on yields when push and pull factors are accounted for. By emphasizing the prominence of country variables, reflecting the quality of countries’ macroeconomic management and their economic performance, our results qualify the common view that SSA countries have little control over their market borrowing costs.

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1. Introduction

During the 1980s and 1990s many Sub-Saharan African (SSA) countries saw an unsustainable build-up of external public debt, due to a toxic combination of commodity boom-bust cycles, easy lending by official creditors and international banks, bad domestic policy and, in some cases, civil war (Brooks et al., 1998; Easterly, 2002; Thomas and Giugale, 2015). Debt relief by creditors was initially limited to non-concessional reschedulings, allowing debtor countries only to postpone repayment.

Gradually, however, it was acknowledged that debt problems transcended temporary liquidity concerns and more extensive debt service and debt stock relief was granted (Cassimon and Essers, 2017). A watershed event was the 1996 Heavily Indebted Poor Countries (HIPC) initiative which aimed at reducing even the worst debt burdens to manageable levels, subject to policy reforms. The HIPC initiative was later deepened and complemented with the Multilateral Debt Relief Initiative (MDRI) in 2005 to result in well over US\$100 billion of debt cancellation for 30 SSA countries. Merotto et al. (2015) show that the public debt to GDP ratio of the average SSA HIPC came down from over 100% prior to HIPC decision points to below 30% just after HIPC/MDRI completion. Also a number of non-HIPCs, most notably Nigeria, have enjoyed large debt relief (Dijkstra, 2013).

Faced with huge infrastructure and other needs, SSA countries have been filling up again the ‘clean slates’ debt relief provided them with by borrowing from a wide range of domestic and external creditors (Prizzon and Mustapha, 2014; Cassimon et al., 2015; Merotto et al., 2015). This paper looks at one channel of external borrowing by SSA sovereigns that has attracted relatively much attention from policymakers, i.e., the issuance

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* Corresponding author.

E-mail addresses: christian.senga@uantwerpen.be (C. Senga), danny.cassimon@uantwerpen.be (D. Cassimon), dennis.essers@uantwerpen.be (D. Essers).

of international bonds in the Eurodollar market (henceforth: Eurobonds) (Mecagni et al., 2014; UNCTAD, 2016).¹

Starting in 2006, no less than 16 SSA governments (excluding South Africa) have issued Eurobonds, most of them for the first time ever, in what *te Velde* (2014) has called a ‘beauty contest’. Taken together, they have raised about US\$29 billion in 35 issuances between September 2006 and June 2017.² Notwithstanding potential benefits from debt diversification, Eurobond issuance holds a number of risks for SSA countries. First of all, the US dollar denomination of these bonds exposes their issuers to exchange rate risks. Because the required principal repayments are concentrated, typically in a single ‘bullet’ installment, Eurobonds also involve greater redemption risks than amortizing loans. In contrast to the syndicated bank loans that dominated the commercial debt of African countries during the 1980s, Eurobonds are marked by a much more diffused and diverse set of creditors (Bertin, 2016). Moreover, it is widely believed that investor appetite for SSA bonds has been fueled by record-low interest rates in advanced economies and commodity price recovery in the aftermath of the global financial crisis, trends that have now reversed or could reverse in the near future (Masetti, 2015; Standard and Poor’s, 2015; Sy, 2015). Indeed, a recent study by *Presbitero et al.* (2016) finds that low-income developing countries are more likely to issue international bonds when US interest rates are low and commodity prices high, particularly so for SSA sovereigns, and that issuance occurs at higher spreads in times of market uncertainty. But next to global factors, domestic fundamentals seem to matter too at issuance. *Presbitero et al.* (2016) show that low-income countries’ propensity to issue Eurobonds rises with economic size and development, lower external debt and higher government effectiveness, and that issue spreads are lower for countries with a stronger current account balance, lower public debt, faster economic growth and an effective government. *Olabisi and Stein* (2015) demonstrate that, even after controlling for such global and domestic variables, SSA sovereigns pay a premium on their bonds at the moment of issuance, relative to other regions.

This paper takes the analysis of SSA Eurobonds beyond the primary market by studying the drivers of the *secondary market* yields of these bonds. Whereas changes in secondary market yields have no immediate impact on the interest costs of existing fixed-rate securities, they do reflect the marginal cost of new borrowing through similar instruments. Concentrating on secondary market yields allows one to exploit important within-country variation, a dimension which is typically very limited in the primary market. It should therefore not come as a surprise that most of the literature on emerging market borrowing takes secondary rather than primary market yields/spreads as the object of study. Given our focus on SSA, where most countries

have so far issued only a few bonds each (usually separated by multiple years), the choice for secondary market yields makes much sense, we believe.

Apart from *Senga and Cassimon* (2018) who investigate spillover effects among SSA Eurobonds, *Gevorkyan and Kvangraven* (2016) is, to the best of our knowledge, the only paper to date that attempts to explain the variation in the secondary market yields of a larger set of SSA Eurobonds.³ With monthly data for nine countries (Republic of Congo, Côte d’Ivoire, Gabon, Ghana, Namibia, Nigeria, Rwanda, Senegal and Zambia) over December 2007 – February 2014, the authors find that yields in SSA are driven by commodity prices, global financial market uncertainty and US interest rates. We build and improve upon *Gevorkyan and Kvangraven* (2016) in several ways. First of all, we extend the sample to 14 countries, discarding the Republic of Congo and adding Angola, Cameroon, Ethiopia, Kenya, Mozambique and Tanzania, and update the time span to June 2017, thereby incorporating the latest oil price bust and recovery, and the start of monetary policy tightening by the US Federal Reserve. Second, next to global factors, we include in our empirical models a broad set of country-level variables, such as international reserves, public debt, GDP growth and inflation. Except for reserves, these variables are absent from the analysis by *Gevorkyan and Kvangraven* (2016). Including domestic macroeconomic fundamentals enables us to capture the domestic ‘pull’ factors that may drive SSA Eurobond yields, besides common international ‘push’ factors. Where possible, we also examine the influence on yields of bond-specific characteristics; among other, the size and maturity of individual bonds, the redemption schedule, and whether or not proceeds are used to fund infrastructure. To evaluate the relative importance of global, domestic and bond-specific variables more formally, we perform a dominance analysis using the methodology of *Azen and Budescu* (2003). Third, relative to *Gevorkyan and Kvangraven* (2016), this paper employs a larger variety of estimators, in line with key studies in the emerging market bond spreads literature (see e.g., *Dailami et al.*, 2008; *Gonzalez-Rozada and Yeyati*, 2008; *Bellas et al.*, 2010; *Kennedy and Palerm*, 2014). To distinguish between long- and short-run dynamics, we formulate a panel error-correction model, which we estimate with the Pooled Mean Group (PMG) estimator of *Pesaran et al.* (1999).

To preview our main conclusions, we find that, beyond global push factors, country-specific pull variables, including inflation and GDP growth, also affect SSA Eurobond yields. Our panel error-correction results suggest large heterogeneity in the short-term influence of global and country explanatory variables across countries. Bond-specific factors such as bond size and maturity generally enter our regressions with the expected signs but are not statistically significant once global and country variables are taken into account. The importance of country variables as drivers of yield is confirmed by our dominance analysis. Hence, the common view that market borrowing costs

¹ The term ‘Eurobond’ generally refers to an international bond denominated in a currency other than that of the issuer or of the place where it is issued. In parallel to issuing Eurobonds, SSA countries have also begun to develop their *domestic* bond markets. For more details, see *Dafe et al.* (2018), *Essers et al.* (2016), *Berensmann et al.* (2015) and *Mu et al.* (2013).

² Not all of this constituted additional funds, however, as some bonds were (partly) issued to roll-over or exchange older debt titles.

³ Some other studies have incorporated a handful of SSA countries in their bond samples, usually as constituents of the JP Morgan Emerging Market Bond Index (EMBI) Plus or Global.

are outside the span of control of SSA countries needs to be qualified.

The remainder of the paper is structured as follows. Section 2 summarizes the relevant literature on emerging and developing country bond yields/spreads. Section 3 describes our SSA sample and outlines the estimation strategy. Our results are presented and discussed in Section 4. Section 5 concludes.

2. Literature review

We look into the existing literature on emerging market bond yields to inform our choice of global factors and country fundamentals to be considered as determinants of SSA sovereign bond yields. For instance, [Hong-Ghi et al. \(2003\)](#) distinguish three categories of variables in their study on emerging market bond spreads, i.e., liquidity and solvency variables, macroeconomic fundamentals, and external shocks. In the first category they group variables such as exports, imports, ratios of debt and foreign reserves to GDP, GDP growth, the current account balance, and the debt service to export ratio. The second category is made up of variables such as inflation (as a proxy of the quality of macroeconomic management), the terms of trade, and the real exchange rate. Finally, US Treasury bill rates and the real oil price are considered as external shocks. The results of [Hong-Ghi et al. \(2003\)](#) indicate that, taken together, liquidity and solvency variables and fundamentals explain most of the spread variations in the 11 emerging market economies they consider during the 1990s. Changes in the US interest rate too appear to affect emerging market spreads. Similar variable categorizations have been used by other studies and their results converge to the importance of some or all of the above variables in determining bond yields and/or spreads (see e.g., [Haque et al., 1996](#); [Genberg and Sulstarova, 2008](#); [Jaramillo and Tejada, 2011](#); [Maltritz et al., 2012](#); [Jahjah et al., 2013](#); [Maltritz and Molchanov, 2013, 2014](#)).

Other, related literature elaborates on the factors affecting capital flows between advanced and emerging economies. With the Lucas paradox⁴ having been empirically invalidated in recent studies ([Reinhardt et al., 2013](#)), most researchers now agree that capital flows are driven by both ‘push’ factors that emanate from the countries where lenders reside and ‘pull’ factors originating in the borrowing countries ([Fratzscher, 2012](#); [Suttle et al., 2013](#); [Gueye and Sy, 2015](#)). A simple but intuitive description of these factors is provided by [Suttle et al. \(2013\)](#), who refer to very loose monetary policy and the prospect of low returns in advanced economies, and higher growth and interest rates in emerging markets as respectively push and pull factors driving the flow of capital between these economies. A more comprehensive view is adopted by [Fratzscher \(2012\)](#). He takes an international diversification perspective and considers common shocks as push factors, and idiosyncratic, country-specific determinants as pull factors in his analysis on the drivers of capital flows from 2005 to 2010. He argues that push factors were

the most important drivers of net capital flows in 2005–2007 and during the 2007–2008 global financial crisis, while pull factors dominate in explaining capital flows to emerging market economies in the recovery period thereafter. A similar view is also taken by [Gueye and Sy \(2015\)](#), who estimate the cost of borrowing by African countries from a model including prevailing push and pull factors.

Interestingly, the foregoing frameworks allow to test the market discipline hypothesis, since the significance of macroeconomic fundamentals (pull factors) can be interpreted as evidence of markets’ ability to discriminate between countries based on their respective economic performance. For example, [Bellas et al. \(2010\)](#) find that fundamentals influence emerging market bond spreads in the long run while financial market volatility is only important in the short run using data on 14 JPMorgan Emerging Market Bond Index (EMBI) constituents from 1997 to 2009. [Dailami et al. \(2008\)](#) consider 17 EMBI countries from 1991 to 2004 and their results indicate a significant, non-linear impact of US interest rate policy on emerging market bond spreads, with countries having moderate debt levels suffering less from increases in US interest rates.

Besides push and pull factors, a notable study by [Feyen et al. \(2015\)](#) sheds light on the importance of bond-specific characteristics in the determination of international bond yields of emerging and developing economies on the primary market (i.e., at issuance). Using a sample of 71 countries over 2000–2014 and controlling for global and country-level factors, [Feyen et al. \(2015\)](#) find a statistically significant positive impact of bond maturity on primary market yields, but no independent effect of bond size.

Also the relatively recent move of SSA countries into international markets has caught the interest of researchers and policymakers. [Sy \(2013\)](#) believes that the record-low interest rates in the US and other advanced economies are the main (push) motive for investors’ purchases of SSA Eurobonds. On the pull side, he cites promising GDP growth supported by stronger policy frameworks, improved governance, and sharply reduced debt burdens. However, [Sy \(2013\)](#) draws a pessimist picture of the sustainability of SSA Eurobonds as, according to him, none of these push or pull factors are expected to continue over the mid to longer term, given, for example, monetary policy normalization in advanced economies.

As mentioned above, our analysis complements the work of [Gevorgyan and Kvangraven \(2016\)](#) by extending the sample of SSA sovereign bonds to more countries, and to more than one bond issue per country when available. Along with this extension, we increase the number of country fundamentals that are considered and distinguish between short- and long-run dynamics in our assessment of the association of global and country-specific factors with bond yields. We also carry out an analysis at the individual bond level to assess the significance of bond-specific characteristics in affecting yields.

⁴ The *Lucas paradox* or the *Lucas puzzle* is the observation that capital does not flow from developed countries to developing countries despite the fact that developing countries have lower levels of capital per worker ([Lucas, 1990](#)).

3. Methodology and data

3.1. Empirical model specification

To empirically investigate the drivers of SSA Eurobond yields in secondary markets, we follow the emerging market bond spreads literature and start with a basic formulation of the long-run relationship between yields, global push factors and country fundamentals/domestic pulls:

$$y_{it} = \alpha_i + \sum_{j=1}^J \beta_j GLOB_{jt} + \sum_{k=1}^K \gamma_k DOM_{kit} + \varepsilon_{it} \quad (1)$$

where y_{it} are the log Eurobond yields of country i at time t ; $GLOB$ and DOM are vectors of, respectively, J global and K domestic variables; β and γ are sets of slope parameters assumed to be the same for all countries; α_i is an intercept that may vary across countries; and ε_{it} are well-behaved error terms. This static model can be estimated using simple pooled OLS (POLS), the random effects (RE) estimator, or fixed effects (FE), depending on the assumptions one makes with respect to α_i . In addition, limiting ourselves to bonds with sufficiently long yield series we can apply Mean Group (MG) estimation, which averages panel-specific coefficients estimated using OLS (Pesaran and Smith, 1995).

Since yields are expected to depend on their own lags and on lags of the independent variables, it makes sense to also consider a more dynamic specification. Taking heterogeneous parameters we can reformulate the model as:

$$y_{it} = \delta_i + \eta_i y_{it-1} + \sum_{j=1}^J \theta_{1ji} GLOB_{jt} + \sum_{j=1}^J \theta_{2ji} GLOB_{jt-1} + \sum_{k=1}^K \lambda_{1ki} DOM_{kit} + \sum_{k=1}^K \lambda_{2ki} DOM_{kit-1} + v_{it} \quad (2)$$

After rearranging we obtain the following panel error-correction representation:

$$\Delta y_{it} = \phi_i [y_{it-1} - \alpha_i - \sum_{j=1}^J \beta_j GLOB_{jt} - \sum_{k=1}^K \gamma_k DOM_{kit}] - \sum_{j=1}^J \theta_{2ji} \Delta GLOB_{jt} - \sum_{k=1}^K \lambda_{2ki} \Delta DOM_{kit} + v_{it} \quad (3)$$

where $\phi_i = (\eta_i - 1)$; $\alpha_i = \frac{\delta_i}{1 - \eta_i}$; $\beta_{ji} = \frac{\theta_{1ji} + \theta_{2ji}}{1 - \eta_i}$; and $\gamma_{ki} = \frac{\lambda_{1ki} + \lambda_{2ki}}{1 - \eta_i}$. The expression in square brackets is the gap between lagged yields and the determinants of their equilibrium levels, with β_{ji} and γ_{ki} the long-run (semi-)elasticities of the variables included in, respectively, $GLOB_j$ and DOM_k for country i (cf. Eq. (1)). The coefficients θ_{2ji} and λ_{2ki} represent the short-run reactions to shocks in global and domestic variables. And error-correction term ϕ_i captures the speed at which countries' bond yields will return to their long-run equilibrium (steady state) after such shocks.

There are again different ways to estimate Eq. (3). First, one can impose homogeneity in all parameters, except intercepts, and estimate a dynamic FE model. Alternatively, one could again

fall back on the estimation of separate regressions for each panel (country) and then examine the averages of all coefficients across panels, i.e., the MG estimator. We prefer the intermediate *Pooled Mean Group* (PMG) estimator, first proposed by Pesaran et al. (1999), which constrains the long-run parameters to be common across panels ($\beta_{ji} = \beta_j$ and $\gamma_{ki} = \gamma_k$), but allows for panel-specific error-correction terms and other short-run parameters.⁵

The PMG approach has intuitive appeal for our purposes and has featured in key studies on emerging market bond spreads (Dailami et al., 2008; Bellas et al., 2010; Kennedy and Palerm, 2014). As noted in those studies, it can be plausibly argued that in the long run financial markets hold economies to the same standards, while in the short run market perceptions of countries' creditworthiness may react differently to similar shocks (be it in global or country variables).

In separate regressions, we also investigate the marginal influence of bond-specific characteristics on secondary market yields, a dimension which is all but absent from the literature on emerging and frontier market bonds (with the notable exception of Feyen et al. (2015), which only considers yields at the time of issuance). More specifically, we extend specification (1) as follows:

$$y_{it} = \alpha_i + \sum_{j=1}^J \beta_j GLOB_{jt} + \sum_{k=1}^K \gamma_k DOM_{kit} + \sum_{l=1}^L \mu_l BOND_{lbt} + \omega_{bit} \quad (4)$$

where $BOND_l$ is a vector of L bond-specific factors for bond b of country i . Since all bond characteristics we consider are time-invariant, we cannot include bond fixed effects. However, the inclusion of country fixed effects α_i in Eq. (4) helps us separate the influence of bond factors from country-specific attributes in countries that have issued multiple bonds. We also use this equation to perform a dominance analysis in the spirit of Azen and Budescu (2003), whereby the respective explanatory power of our exogenous variables is assessed. More specifically, the general dominance of one (or set of) independent variable(s) over other regressors is determined based on a comparison of dominance statistics, computed as the weighted average marginal contribution to the overall fit statistic that an (or set of) independent variable(s) makes across all models in which it is included.⁶ Such a dominance analysis further clarifies the relative importance of global, country-specific and bond-level factors in explaining the evolution of SSA Eurobond yields.

⁵ It is well known that, because of the correlation between the lagged dependent variable and the error term, all three estimators will show bias, which diminishes with longer time series (Nickell, 1981). Since the time dimension of our sample dominates the cross-sectional dimension we assume that our series are long enough to mitigate this dynamic panel bias (Gonzalez-Rozada and Yeyati, 2008).

⁶ For a more detailed discussion of the dominance analysis, see Budescu (1993) and Azen and Budescu (2003).

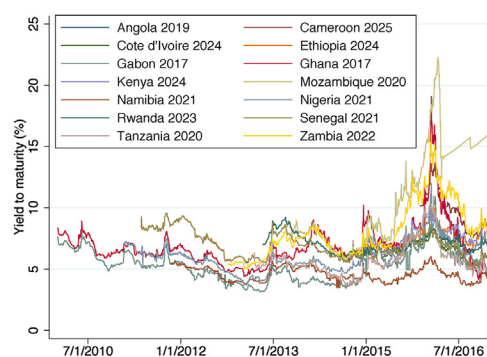
3.2. Our dataset

We have been able to collect secondary market yields-to-maturity for 31 sovereign Eurobonds of 14 SSA countries from Thomson Reuters Datastream (see Appendix Table A.1). This covers the near-universe of non-South African SSA sovereign Eurobonds issued between September 2006 and September 2016.⁷ For our first set of yield regressions, in which we focus on the role of global push versus country pull factors and leave aside bond specifics, we limit ourselves to one bond per country, so as to better balance the sample in terms of country observations. In case a country has issued multiple bonds, we select for each country the bond with the longest yield series (typically countries' debut bonds), in order to maximize the time dimension of our estimation. After averaging Eurobond yields at monthly frequency between January 2008 and June 2017, we end up with an unbalanced panel dataset of 14 countries/bonds and 795 observations in total. When estimating Eq. (4), which includes bond characteristics, we make use of the whole sample of 31 SSA Eurobonds, considering multiple issues per country where available.

We follow the literature and take the Bloomberg Commodity Index, the VIX and yields on 10-year US Treasury bonds to capture the influence of, respectively, global commodity prices, market volatility and liquidity/monetary conditions, i.e., the push factors in our model. As pull factors, we select the following macroeconomic fundamentals: the current account balance, government debt, primary fiscal balance, foreign reserves, GDP growth, exchange rate changes, and inflation. All country variables have been collected at their highest available frequencies and interpolated to monthly frequency where needed. Appendix Table A.2 provides the exact definitions and original sources of our variables.

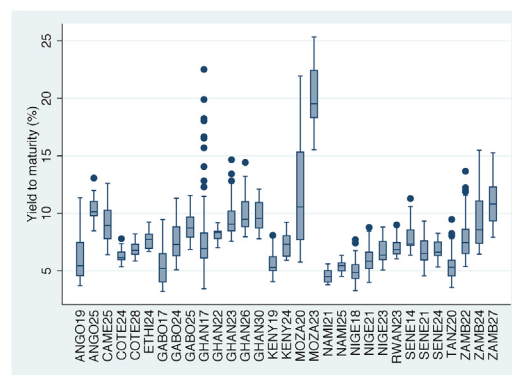
As concerns bond characteristics, we have constructed (time-invariant) dummies to distinguish between bonds involving a single bullet redemption of the principal and bonds with some amortization; debut and non-debut bonds; bonds with different sizes (below, equal to, or above US\$1 billion) and original maturities (less than, equal to, or more than 10 years); and whether or not the stated use of proceeds (explicitly) includes an infrastructure component. The rationale for including the infrastructure bond dummy is that infrastructure investments are easier to monitor by international investors and may start generating returns earlier than, say, investments in education or health. This could instill relatively more trust in infrastructure bonds. All infor-

⁷ To ensure a minimum time series dimension for yields, we do not include more recently issued SSA Eurobonds. Bonds for which no or insufficient yield data could be retrieved from Datastream are the 2006 and 2010 issues of the Seychelles, the 2007 issue of the Republic of Congo, and the 2010 issue of Côte d'Ivoire. We do include in our sample a number of bonds that are, strictly speaking, not 'sovereign Eurobonds' but have similar characteristics: Angola's 2012 loan participation notes issued by Northern Lights III, a special purpose vehicle backed by Russian bank VTB Capital, but with the Angolan government as the ultimate guarantor; Mozambique's 2013 government-guaranteed bond, issued by state-owned tuna fishing company Ematum; and the Tanzanian government's 2013 privately placed floating rate notes.



Notes: 14 bonds shown are those with the longest available yield series and are included in the samples of Tables 3 and 4. Years refer to maturity date. See Appendix Table A1 for details.

Fig. 1. Evolution of yields of selected SSA Eurobonds.



Notes: 31 bonds shown are those included in the samples of Tables 5 to 8. Two last digits refer to year in which bond matures. See Appendix Table A1 for details.

Fig. 2. Boxplots of SSA Eurobond yields.

mation on bond characteristics was sourced from the original prospectus documents.⁸

Figs. 1 and Figure 2 show the evolution and dispersion of SSA Eurobond yields. It is clear that these yields do tend to follow similar trends, but also that there is quite some heterogeneity between bonds/countries. Whereas most yields are found in the 5–10% range, within-bond yield variation is substantial. Bonds like those of Ghana, Zambia and Mozambique have seen yields exceeding 15% at times. Mozambique in particular appears to be an outlier in terms of Eurobond yields. This may not come as a surprise, given the scandals that have developed around Mozambique's bonds (and a set of other, undisclosed loans) and the country's ultimate default early 2017 (Hanlon, 2016; IMF, 2018). We take the special case of Mozambique into account when testing the robustness of our econometric results. Sum-

⁸ For example, in the prospectus of the 2013 Eurobond of Gabon one can read: "The net proceeds of the Offered Notes will be used to accelerate and support the infrastructure projects identified by the *Schéma directeur national des infrastructures*, including the development of the bypass road in the Owendo zone, the development of electricity generation and transmission, in particular the *Chutes de l'Impératrice* dam, the finalisation of the Libreville-Franceville road and the South and South-West corridors". Conversely, the prospectus of the 2011 Nigerian Eurobond states: "The net proceeds of the issue, after payment of commissions and expenses, will be used for general budgetary purposes". Accordingly, we classify the first (second) bond as an infrastructure (non-infrastructure) bond.

Table 1
Summary statistics of global and country variables.

Variable	Obs.	Mean	Std. Dev.	Min	Max
SSA Eurobond yield (YIELD)	1255	0.073	0.026	0.032	0.253
Bloomberg commodity index (BCOM)	3385	374.036	65.539	235.59	509.133
VIX	3385	0.222	0.079	0.124	0.563
10-year US Treasury bond yield (USTB)	3385	0.026	0.007	0.015	0.040
Current account balance to GDP (CABAL)	3385	0.181	6.038	−15.763	29.154
Government gross debt to GDP (DEBT)	3385	36.900	18.126	7.276	115.2
Government fiscal balance to GDP (FISCBAL)	3385	−1.639	3.698	−9.642	12.642
Foreign reserves to GDP (RES)	3385	10.629	6.067	0.016	31.037
GDP growth (GDPGR)	3385	0.004	0.011	−0.026	0.034
Exchange rate change (XRTCH)	3385	0.007	0.036	−0.194	0.350
Inflation (INFL)	3385	0.007	0.008	−0.043	0.098
Log SSA Eurobond yield (LYIELD)	1255	−2.674	0.314	−3.442	−1.373
Log Bloomberg commodity index (LBCOM)	3385	5.908	0.182	5.462	6.233
Log VIX (LVIX)	3385	−1.557	0.307	−2.086	−0.575
Log 10-year US Treasury bond yield (LUSTB)	3385	−3.689	0.283	−4.230	−3.210

Notes: For variable definitions and sources, see Appendix Table A.2.

Table 2
Pairwise correlations between yields and main explanatory variables.

	LYIELD	LBCOM	LVIX	LUSTB	CABAL	DEBT	FISCBAL	RES	GDPGR	XRTCH	INFL
LYIELD	1.0000										
LBCOM	−0.4570*	1.0000									
LVIX	0.2633*	−0.3070*	1.0000								
LUSTB	−0.0188	0.0417*	0.3266*	1.0000							
CABAL	−0.3074*	0.1418*	0.1775*	0.1644*	1.0000						
DEBT	0.5246*	−0.1781*	−0.3108*	−0.2676*	−0.4892*	1.0000					
FISCBAL	−0.1662*	−0.0142	0.1995*	0.1390*	0.4309*	−0.3007*	1.0000				
RES	−0.0142	0.0692*	−0.0328	0.0147	0.2198*	−0.1442*	0.2479*	1.0000			
GDPGR	−0.1551*	0.4007*	0.0942*	0.2575*	0.2050*	−0.1618*	0.0823*	0.0540*	1.0000		
XRTCH	0.0687*	−0.0869*	0.0748*	−0.0363*	−0.0563*	0.0355*	−0.0659*	−0.0270	−0.1071*	1.0000	
INFL	0.3039*	−0.0264	0.0034	0.0875*	−0.0257	0.0987*	−0.1147*	0.1996*	−0.0032	0.1001*	1.0000

Notes: For variable definitions and sources, see Appendix Table A.2.

* Significant at 5% level.

mary statistics and pairwise correlations between (log) yields and the above-described global and country-level variables are presented in Tables 1 and Table 2. Yields correlate positively with the VIX, debt to GDP ratio, exchange rate depreciation, and inflation, and negatively with commodity prices, the current account balance, primary fiscal balance, and GDP growth. In the next section we investigate the drivers of yields in a multivariate setting.

4. Empirical results and discussion

4.1. Push and pull factors

Table 3 presents the results of the estimation of Eq. (1) based on our one-bond-per-country dataset. The presence of panel effects is confirmed by the Breusch-Pagan Lagrangian Multiplier (LM) test, whereas the Hausman test cannot reject the null hypothesis of non-systematic differences between FE and RE coefficients at the 10% significance level. Although static, the results suggest significant correlations of several global and country variables with secondary market SSA Eurobond yields. On the push side, the results show, as expected, an inverse rela-

tion between SSA yields and global commodity prices, and a positive relation between SSA yields and both the VIX and US Treasury bond yields. On the pull side, we find significant negative effects of GDP growth on SSA yields and positive influences of government debt to GDP and inflation. A plausible interpretation is that higher GDP growth and lower debt increase repayment probabilities and thus investor trust, whereas lower inflation may signal better macroeconomic management. The coefficients of the current account balance and reserves to GDP have the expected negative sign when estimated using RE or FE, but are not significantly different from zero. The MG estimator, which ignores the panel dimension by just averaging the coefficients obtained by country-specific estimations, confirms the significance of the global factors and of inflation. Debt and reserves to GDP are also significant, but the coefficients have counterintuitive signs. Note, however, that MG estimation may suffer from the still relatively short time series for some countries/bonds. Therefore, overall, these first static estimations seem to suggest that, beyond the global environment, investors also consider country-level conditions and discriminate between countries accordingly. The right-hand side of Table 3 shows the outcome of the same estimations when Mozambique's (Ema-

Table 3
Estimation results for static model specification.

Dep. variable:	Full sample				Excluding Mozambique			
	OLS	RE	FE	MG	OLS	RE	FE	MG
LBCOM	−0.524 ^{**} (0.218)	−0.291 [*] (0.167)	−0.283 (0.166)	−0.614 ^{***} (0.132)	−0.650 ^{***} (0.193)	−0.418 ^{***} (0.138)	−0.411 ^{**} (0.137)	−0.565 ^{***} (0.121)
LVIX	0.530 ^{***} (0.0703)	0.691 ^{***} (0.0646)	0.693 ^{***} (0.0642)	0.393 ^{***} (0.0586)	0.497 ^{***} (0.0654)	0.621 ^{***} (0.0449)	0.624 ^{***} (0.0457)	0.392 ^{***} (0.0631)
LUSTB	0.294 ^{***} (0.0623)	0.351 ^{***} (0.0432)	0.353 ^{***} (0.0426)	0.174 ^{***} (0.0580)	0.251 ^{***} (0.0597)	0.305 ^{***} (0.0341)	0.307 ^{***} (0.0339)	0.209 ^{***} (0.0608)
CABAL	0.00291 (0.00353)	−0.00386 (0.00273)	−0.00388 (0.00273)	0.0339 (0.0509)	−7.11e−05 (0.00378)	−0.00456 (0.00322)	−0.00461 (0.00324)	0.0357 (0.0600)
DEBT	0.00655 [*] (0.00336)	0.00651 ^{**} (0.00293)	0.00653 ^{**} (0.00289)	−0.00960 ^{**} (0.00489)	0.00203 (0.00193)	0.00255 ^{**} (0.00118)	0.00264 ^{**} (0.00120)	−0.0117 ^{**} (0.00544)
FISCBAL	−0.0104 (0.0128)	0.0119 (0.00954)	0.0129 (0.00952)	0.0191 (0.0524)	−0.0112 (0.0143)	0.00410 (0.00832)	0.00450 (0.00815)	0.0160 (0.0597)
RES	−0.00578 (0.00453)	−0.0114 (0.00825)	−0.0125 (0.00925)	0.0156 [*] (0.00875)	−0.00856 (0.00499)	−0.00852 (0.00814)	−0.00869 (0.00872)	0.0162 [*] (0.00972)
GDPGR	−3.072 (2.063)	−3.385 ^{**} (1.437)	−3.399 ^{**} (1.449)	0.574 (1.809)	−0.233 (1.701)	−2.506 ^{**} (1.109)	−2.552 ^{**} (1.113)	0.277 (2.026)
XRTCH	0.00782 (0.207)	−0.0933 (0.194)	−0.0977 (0.193)	0.172 (0.214)	0.152 (0.193)	0.0639 (0.201)	0.0624 (0.200)	0.235 (0.229)
INFL	5.217 ^{**} (2.331)	4.639 ^{***} (1.006)	4.629 ^{***} (0.994)	2.098 ^{**} (0.942)	6.200 ^{**} (2.547)	4.502 ^{***} (1.258)	4.491 ^{***} (1.258)	1.846 [*] (1.076)
Constant	2.125 [*] (1.161)	1.412 (0.910)	1.340 (0.916)	2.208 [*] (1.256)	2.817 ^{**} (1.016)	1.943 ^{**} (0.785)	1.868 ^{**} (0.786)	1.844 (1.266)
Observations	776	776	776	776	731	731	731	731
Countries		14	14	14		13	13	13
R ²	0.538	0.622	0.622		0.524	0.618	0.618	
Breusch-Pagan LM	3386.69 ^{***}				2580.36 ^{***}			
Hausman	8.98				6.61			

Notes: Estimation results based on Eq. (1). For variable definitions and sources, see Appendix Table A.2. Robust standard errors, clustered at the country level, in parentheses.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

tum) bond is excluded from the sample (given its peculiar nature and yield history). The results are qualitatively very similar. Economically speaking, the influence of commodity prices is slightly stronger and that of debt to GDP somewhat weaker (in case of the OLS, RE and FE estimations).

Before moving to a dynamic analysis, we have looked into the time series characteristics of our variables. Although, as is often the case, the results are not 100% conclusive, Fisher-type Augmented Dickey-Fuller tests and Im et al. (2003) panel unit root tests suggest that the variables in our panel (after applying log transformations where appropriate) are integrated of order one at maximum (cf. Gevorkyan and Kvangraven, 2016).⁹ We therefore proceed with a panel error-correction model as represented by Eq. (3) and estimated using the PMG techniques proposed by Pesaran et al. (1999) and applied by Dailami et al. (2008), Bellas et al. (2010), Kennedy and Palerm (2014) and others to similar (non-SSA) bond yield regressions.

The results of our PMG estimation are presented in Table 4. First of all, we find a significant, negative error-correction term for all countries. The estimated values of ϕ vary considerably

across countries and indicate that between 14% and 65% of the short-term deviations in bond yields from their long-run equilibrium are eliminated over a one month time span. In line with our previous, static estimates, the common long-term coefficients in Table 4 show a significant inverse relationship of yields with commodity prices and GDP growth, and positive associations with the VIX, US Treasury bond yields and inflation. Additionally, we find a small but statistically significant negative effect of the current account balance and a positive effect of the fiscal balance and exchange rate depreciation. Whereas the positive fiscal balance coefficient is counterintuitive, a depreciation of the exchange rate increases the burden of dollar-denominated debt in local currency terms and may therefore feed into increased yields. The short-term influence of our explanatory variables on yields is very heterogeneous across countries; apart from the downward effect of commodity prices, which is statistically and economically significant for nearly all countries, we find little commonality in the magnitude and even direction of the other short-term coefficients. Of course, given the limited time dimension of some countries' bond yields, one needs to be cautious in interpreting these short-term country-specific coefficients.

Up to this point, our results emphasize the importance of both push (global commodity prices, market volatility and liq-

⁹ Results not shown, but available from the authors upon request.

Table 4
Estimation results for dynamic model specification.

Dep. variable:	Short-term coefficients															Long-term coeff.
	Angola	Cameroon	Côte d'Ivoire	Ethiopia	Gabon	Ghana	Kenya	Mozambique	Namibia	Nigeria	Rwanda	Senegal	Tanzania	Zambia	Average	
LBCOM	-1.132*** (0.335)	0.220 (0.185)	-0.313** (0.160)	-0.179 (0.160)	-0.529** (0.250)	-0.658*** (0.182)	-0.384** (0.168)	-0.264 (0.330)	-0.311** (0.152)	-0.380* (0.204)	-0.0819 (0.164)	-0.384** (0.188)	-0.218 (0.368)	-0.141 (0.224)	-0.340*** (0.0825)	-0.231*** (0.0871)
LVIX	0.0923 (0.117)	-0.408*** (0.141)	-0.141** (0.0567)	-0.0728 (0.0648)	-0.138 (0.0899)	0.165** (0.0784)	-0.122** (0.0581)	-0.109 (0.122)	-0.0403 (0.0633)	-0.0153 (0.0672)	-0.0503 (0.0593)	0.124* (0.0644)	0.165 (0.115)	0.113 (0.0741)	-0.0311 (0.0419)	0.698*** (0.0525)
LUSTB	-0.223* (0.124)	-0.662*** (0.112)	-0.122 (0.0811)	-0.00351 (0.0700)	-0.208* (0.114)	-0.103 (0.0982)	0.00317 (0.0788)	-0.288** (0.144)	0.0589 (0.0842)	-0.0324 (0.0873)	-0.00440 (0.0681)	0.140* (0.0803)	0.0366 (0.146)	-0.0902 (0.0913)	-0.107** (0.0531)	0.676*** (0.0478)
CABAL	0.0921** (0.0423)		1.051*** (0.359)		0.427*** (0.158)	-0.0697 (0.116)	-0.316* (0.176)	2.884*** (0.805)	-0.0558 (0.163)	0.0259** (0.0118)	-1.212 (1.233)	-0.420 (0.369)	4.027 (3.355)	-0.385*** (0.120)	0.432 (0.371)	-0.00499** (0.00245)
DEBT	-0.00639 (0.0300)		0.338** (0.140)	-0.190*** (0.0432)	0.124*** (0.0312)	0.00582 (0.0236)	1.815*** (0.606)	-0.103*** (0.0260)	-0.0682*** (0.0192)	-0.0614 (0.0577)	0.367 (0.256)	0.0180 (0.0391)	-2.365 (1.887)	-0.0237 (0.0169)	-0.0107 (0.225)	0.00109 (0.00179)
FISCBAL	0.0660 (0.0856)		-2.439*** (0.719)	0.348 (0.219)	-0.0213 (0.0226)	-0.0142 (0.0526)	2.947*** (0.926)	0.222*** (0.0530)	0.0332 (0.0369)	-0.0900* (0.0528)	-0.0681 (0.123)	-0.147 (0.191)	3.192 (3.322)	0.0854 (0.0520)	0.294 (0.362)	0.0142** (0.00567)
RES	0.0287* (0.0159)	0.00996 (0.0536)	0.0554 (0.0946)	0.0355* (0.0188)	-0.0138 (0.0106)	-0.0124 (0.00979)	0.0224 (0.0155)	-0.00405 (0.0150)	0.00147 (0.00385)	-0.0114 (0.0284)	-0.0112 (0.00936)	-0.222 (0.256)	-0.0182 (0.0474)	0.00920 (0.00798)	-0.00930 (0.0174)	0.00491 (0.00531)
GDPGR	2.215 (2.234)	12.78** (5.010)	3.191 (1.954)	0.137 (18.13)	1.626 (1.767)	2.974 (1.855)	9.356** (4.521)	0.465 (3.011)	0.258 (2.087)	0.633 (2.486)	-4.858 (7.397)	-0.0818 (2.657)	3.924 (6.741)	0.496 (1.955)	2.365** (1.146)	-10.57*** (2.187)
XRTCH	0.877** (0.397)	0.677 (0.417)	0.0884 (0.232)	-2.281 (3.084)	0.248 (0.255)	0.602*** (0.201)	0.273 (0.618)	-0.0770 (0.188)	-0.131 (0.116)	-0.119 (0.150)	0.185 (0.420)	-0.0701 (0.222)	0.379 (0.423)	0.133 (0.115)	0.0560 (0.198)	0.530** (0.255)
INFL	-4.458 (4.532)	6.399** (2.880)	-0.302 (1.134)	0.207 (0.927)	-0.0661 (0.816)	0.969 (2.016)	-0.159 (1.196)	-0.798 (1.904)	-0.210 (1.674)	-2.077* (1.206)	0.242 (0.781)	-0.950 (1.155)	2.402 (5.000)	2.421** (1.173)	0.258 (0.657)	3.694** (1.442)
Constant	1.031*** (0.364)	1.876*** (0.384)	0.990*** (0.281)	1.397*** (0.342)	0.697*** (0.235)	0.320** (0.130)	0.451* (0.242)	1.459*** (0.423)	0.978*** (0.297)	1.172*** (0.324)	0.669*** (0.229)	0.482*** (0.184)	0.770** (0.348)	0.519*** (0.189)	0.915*** (0.119)	
Error-correction (ϕ)	-0.459*** (0.114)	-0.653*** (0.0786)	-0.468*** (0.0809)	-0.506*** (0.0941)	-0.384*** (0.0727)	-0.144*** (0.0466)	-0.346*** (0.0763)	-0.556*** (0.112)	-0.477*** (0.0873)	-0.507*** (0.0908)	-0.330*** (0.0788)	-0.200*** (0.0630)	-0.216* (0.112)	-0.202*** (0.0622)	-0.389*** (0.0413)	

Notes: Estimation results based on Eq. (3). For variable definitions and sources, see Appendix Table A.2. For Cameroon and Ethiopia, some short-term coefficients could not be estimated, because of insufficient variation. The number of observations is 762. Robust standard errors, clustered at the country level, in parentheses.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

Table 5
Estimation results for extended model specification.

Dep. variable: LYIELD	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LBCOM	−0.945*** (0.102)	−0.796*** (0.160)	−0.788*** (0.160)	−0.771*** (0.153)	−0.770*** (0.152)	−0.788*** (0.144)	−0.781*** (0.142)
LVIX	0.350*** (0.0311)	0.373*** (0.0268)	0.370*** (0.0267)	0.372*** (0.0290)	0.375*** (0.0248)	0.367*** (0.0277)	0.367*** (0.0288)
LUSTB	0.363*** (0.0330)	0.376*** (0.0379)	0.377*** (0.0373)	0.376*** (0.0392)	0.378*** (0.0355)	0.377*** (0.0350)	0.380*** (0.0351)
CABAL		−0.00595 (0.00356)	−0.00668* (0.00332)	−0.00634* (0.00349)	−0.00673* (0.00320)	−0.00552 (0.00325)	−0.00561* (0.00288)
DEBT		0.0130*** (0.00165)	0.0129*** (0.00154)	0.0121*** (0.00183)	0.0129*** (0.00150)	0.0108*** (0.00205)	0.0104*** (0.00217)
FISCBAL		0.0102 (0.0109)	0.00836 (0.00960)	0.00847 (0.00979)	0.0122 (0.00870)	0.0108 (0.00930)	0.00967 (0.00975)
RES		−0.00674 (0.00565)	−0.00879 (0.00615)	−0.0100 (0.00621)	−0.00965 (0.00594)	−0.00692 (0.00734)	−0.00654 (0.00707)
GDPGR		−2.117* (1.035)	−1.966* (0.916)	−2.156** (0.901)	−1.943** (0.786)	−2.390** (0.900)	−2.658*** (0.854)
XRTCH		0.0748 (0.115)	0.0761 (0.116)	0.0690 (0.115)	0.0805 (0.115)	0.0673 (0.117)	0.0734 (0.122)
INFL		2.126** (0.840)	2.526** (0.846)	2.453** (0.816)	2.608*** (0.827)	2.105* (1.029)	1.954* (0.989)
BULLET			−0.123* (0.0670)	−0.0989 (0.0584)	−0.123* (0.0672)	−0.0618 (0.0665)	−0.0131 (0.133)
DEBUT				−0.0900 (0.0795)			
INFRA					0.0722 (0.0418)		
SIZE:							
<US\$1 BN						−0.0916 (0.147)	−0.0912 (0.158)
>US\$1 BN						0.141 (0.122)	0.0901 (0.132)
MATURITY:							
10Y							0.0507 (0.118)
>10Y							0.140 (0.0852)
Constant	4.507*** (0.533)	3.614*** (0.928)	3.657*** (0.967)	3.711*** (0.979)	3.579*** (0.927)	3.684*** (0.921)	3.649*** (0.922)
Observations	1255	1255	1255	1255	1255	1255	1255
R ²	0.692	0.742	0.755	0.767	0.763	0.779	0.782
Wald F		33.57***	3.35*	1.28	2.98	4.00**	1.36
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Estimation results based on Eq. (4). For variable definitions and sources, see Appendix Table A.2 and main text. Robust standard errors, clustered at the country level, in parentheses.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

uidity) and pull factors (GDP growth and inflation) in the long and/or short run dynamics of SSA sovereign Eurobond yields. In the next section we investigate whether the inclusion of bond characteristics alters these findings.

4.2. Bond-specific factors

The effects of bond-specific factors on SSA Eurobond yields are analyzed by extending our sample to multiple bonds per country, wherever they exist, and by estimating Eq. (4). To determine the marginal influences of individual bond characteristics,

we progressively add (sets of) variables to the estimation and check their contribution to the overall fit of the model using Wald tests of joint significance. Country and year dummies are included to purge uncaptured country and time/year-specific effects from the estimations. Our identification of the effects of bond characteristics is therefore based on within-country, within-year variation in Eurobond yields.

The results of our sequence of estimations are presented in Table 5. Once again, we find that both global push and country pull factors matter for SSA Eurobond yields. A Wald test confirms that adding country-specific variables to the global

Table 6
Estimation results for extended model specification, by variable group.

Dep. variable: LYIELD	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
LBCOM	−0.954*** (0.224)			−0.904*** (0.138)			−0.876*** (0.203)			−0.945*** (0.102)		
LVIX	0.373*** (0.0792)			0.321*** (0.0305)			0.377*** (0.0583)			0.350*** (0.0311)		
LUSTB	0.211*** (0.0487)			0.327*** (0.0343)			0.171*** (0.0326)			0.363*** (0.0330)		
CABAL		−0.00167 (0.00387)			0.00176 (0.00406)			−0.00650*** (0.00194)			−0.00827** (0.00322)	
DEBT		0.00806*** (0.00185)			0.00853*** (0.00180)			0.00530* (0.00282)			0.0138*** (0.00186)	
FISCBAL		0.00261 (0.0120)			0.000408 (0.0148)			0.00491 (0.0174)			0.00627 (0.0145)	
RES		−0.00930 (0.00586)			−0.00732 (0.00553)			−0.0143 (0.0183)			−0.00158 (0.00892)	
GDPGR		−3.661 (2.292)			−4.748* (2.253)			−1.817* (0.879)			−1.436 (1.161)	
XRTCH		0.113 (0.144)			0.0818 (0.147)			0.0535 (0.0956)			0.128 (0.121)	
INFL		9.493** (3.299)			7.401** (2.788)			7.475** (3.252)			3.336* (1.787)	
BULLET			0.0441 (0.180)			0.0264 (0.174)			0.0999 (0.181)			0.0416 (0.175)
DEBUT			−0.121 (0.0796)			−0.114 (0.0671)			−0.0633 (0.0961)			−0.0668 (0.0995)
INFRA			0.0854 (0.0781)			0.0586 (0.0747)			0.0642 (0.0695)			0.0352 (0.0718)
SIZE:												
< US\$1 BN			0.126 (0.0737)			0.0782 (0.0795)			−0.114 (0.150)			−0.117 (0.136)
>US\$1 BN			0.175 (0.131)			0.144 (0.116)			0.0668 (0.185)			0.0835 (0.172)
MATURITY:												
10Y			−0.00565 (0.179)			−0.0223 (0.176)			0.0889 (0.160)			0.0652 (0.171)
>10Y			0.127 (0.117)			0.0856 (0.103)			0.284* (0.144)			0.188 (0.122)
Constant	4.366*** (1.177)	−2.983*** (0.0792)	−2.779*** (0.0989)	4.269*** (0.807)	−2.771*** (0.0554)	−2.550*** (0.134)	3.755*** (1.025)	−2.771*** (0.516)	−2.631*** (0.162)	4.507*** (0.533)	−2.958*** (0.190)	−2.545*** (0.171)
Observations	1255	1255	1255	1255	1255	1255	1255	1255	1255	1255	1255	1255
R ²	0.286	0.355	0.157	0.321	0.484	0.325	0.665	0.535	0.525	0.692	0.661	0.668
Country FE	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	No	No	No	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes

Notes: Estimation results based on Eq. (4). For variable definitions and sources, see Appendix Table A.2 and main text. Robust standard errors, clustered at the country level, in parentheses.

* $p < 0.1$.

** $p < 0.05$.

*** $p < 0.01$.

factors-only model significantly improves the model fit. In this larger, multiple-bonds-per-country sample the negative association of yields with GDP growth and positive association with the debt to GDP ratio and inflation stand out as pull factor influences. The coefficients of the current account balance, reserves to GDP ratio, and exchange rate depreciation have the expected signs but are not (or only marginally) statistically different from zero in this model set-up. The inclusion of different sets of bond-specific factors, i.e., a bullet repayment dummy, debut bond dummy, infrastructure bond dummy, and bond size and maturity dummies, leaves these results largely unchanged and does not contribute much in terms of a better model fit. That notwithstanding, the bond size and maturity coefficients do have the expected signs; larger and longer-maturity Eurobonds bear higher yields, but not significantly so in our SSA sample.

4.3. Dominance analysis

The main conclusion of our analysis so far is that SSA Eurobond yields are driven by global (push), country-specific (pull) and, to a much lesser degree, bond-specific factors. In this section we attempt to shed further light on the relative importance of these three variable groups in explaining the evolution of yields, motivated by the focus of previous studies on SSA Eurobonds (Gevorkyan and Kvangraven, 2016, in particular) on global factors. We start by fitting Eq. (4) with global, country and bond variables separately (holding the sample constant), with and without country and/or year fixed effects. Table 6 shows that, when none of the country or time fixed effects are included, a model with global variables has an R^2 of 28.6%, less than the 35.5% explained variance in the country-variables-only model

Table 7
Dominance analysis, three variable sets.

Dep. variable: LYIELD	Dominance statistics	Standardized dom. stat.	Ranking
Set 1: Global factors, incl. year dummies	0.2504	0.3166	2
Set 2: Country-specific factors, incl. country dummies	0.4494	0.5682	1
Set 3: Bond-specific factors	0.0910	0.1151	3
Overall fit statistic: 0.791			
Observations: 1255			

Notes: Results based on Eq. (4). For variable definitions and sources, see Appendix Table A.2 and main text.

Table 8
Dominance analysis, five variable sets.

Dep. variable: LYIELD	Dominance statistics	Standardized dom. stat.	Ranking
Set 1: Global factors, excl. year dummies	0.1555	0.1966	3
Set 2: Year dummies	0.1074	0.1358	4
Set 3: Country-specific factors, excl. country dummies	0.1632	0.2063	2
Set 4: Country dummies	0.2861	0.3618	1
Set 5: Bond-specific factors	0.0787	0.0995	5
Overall fit statistic: 0.791			
Observations: 1255			

Notes: Results based on Eq. (4). For variable definitions and sources, see Appendix Table A.2 and main text.

and substantially more than the 15.7% of the bond-variables-only model. Adding year fixed effects improves the fit of the global-variables-only model to a lesser extent than it boosts the fits of the two other models, due to the fact that time trends are already partly captured by the global variables. Likewise, the inclusion of country fixed-effects has a smaller impact on the country-variables-only model than on the other two models. Once both country and year fixed effects are accounted for, the model fit is comparable across the three models, with just a slight edge of the global-variables-only model (R^2 of 69.2%) over the other two (R^2 s of 66.1% and 66.8%).

To evaluate the relative importance of each of these sets of variables somewhat more formally, we also perform a dominance analysis along the lines of Azen and Budescu (2003). As mentioned in Section 3.1, this approach calculates and compares dominance statistics, i.e., the weighted average marginal contributions to the overall fit statistic that different set of variables make across *all* models in which they are included. We consider two different categorizations. In the first set-up, we categorize our potential Eurobond yield determinants in three groups: global factors, i.e., our proxies for global commodity prices, market volatility and liquidity, *and* year dummies (capturing some of the omitted time effects); country factors, i.e., the earlier-used macroeconomic fundamentals *and* country dummies (capturing omitted country variation in institutional and other dimensions); and the bond-specific variables of Section 4.2. In the second set-up, year dummies and country dummies are regarded as separate categories, so that we end up with five variable groups.

The results of the dominance analysis with three and five variable sets are shown in Tables 7 and Table 8, respectively. Altogether, country factors account for no less than 56.8% of the explained variance in SSA Eurobond yields, compared to 31.7% for the global factors and 11.5% for the bond-specific

factors. When global and country variables are split into identified and non-identified factors, it appears that country dummies explain the largest part of the variance in yields (36.2%), followed by country fundamentals (20.6%) and (identified) global factors (19.7%). Bond-specific factors contribute the least in terms of explained variance (10%) in our sample. We draw two conclusions from this exercise. First, global push factors are indeed key to understand the evolution in SSA Eurobond yields, but country-specific pulls are at least as important, meaning that SSA sovereign do have a degree of control over their market borrowing costs. Second, given the dominance of country dummies over the country fundamentals we selected, more work is needed in identifying the specific country characteristics that investors take into account when trading SSA Eurobonds.

5. Concluding remarks

This paper has revisited the drivers of secondary market SSA Eurobond yields. Covering the near-universe of (non-South African) SSA sovereign Eurobonds, we have investigated the global, country and bond-specific determinants of yields, performed a dynamic analysis to distinguish short- and long-term relations between yields and their key drivers, and formally tested the relative explanatory power of different variable sets using dominance analysis. Above all, our results indicate that beyond the global ‘push’ factors that have already been documented in previous research, country-specific ‘pull’ factors, most notably inflation and GDP growth, matter too for SSA Eurobond performance. A panel error-correction model suggests large heterogeneity in the short-term influence of our global and country variables across countries; only global commodity prices are found to have a significant short-term association with yields across the board. Bond characteristics, including bond size, maturity, redemption schedule and whether bond proceeds

are used to finance infrastructure, seem to have no significant bearing on yields in our sample once push and pull factors are accounted for. Further research may be needed in this area as more data on multiple bond issues per country becomes available.

Our dominance analysis confirms that (identified and unidentified) country-specific factors are at least as important as global factors in explaining the variance in SSA Eurobond yields. Our results thus qualify the common view that SSA countries have little control over their market borrowing costs. In line with the market discipline hypothesis, investors in SSA Eurobonds seem to discriminate between borrowers based on the quality of their macroeconomic management and economic performance. Given the dominance of country dummies over the country fundamentals we have explicitly considered in our models, further

research is needed in identifying the country characteristics that investors pay attention to.

The time period covered by our paper, 2008 to mid-2017, was characterized by sluggish economic performance in most advanced economies, following the global financial and European sovereign debt crises. The resumption of positive global economic prospects in advanced economies since 2017 may herald the start of an episode of portfolio rebalancing that could also impact SSA Eurobond performance. The question of whether this recovery triggers a flight home by advanced country investors is an interesting avenue for future research on the influence of global factors on SSA Eurobond yields.

Appendix A.

Table A.1
SSA Eurobonds sample.

Country/issuer	Issue date	Maturity date	Size (US\$ millions)	ISIN (RegS/144A)
Ghana*	9/27/2007	10/4/2017	750	XS0323760370/US374422AA15
Gabon*	12/6/2007	12/12/2017	1000	XS0333225000/US362420AA95
Senegal	12/15/2009	12/22/2014	200	XS0474859757
Nigeria*	1/21/2011	1/28/2021	500	XS0584435142/US65412AAA07
Senegal*	5/13/2011	5/13/2021	500	XS0625251854/US81720TAA34
Namibia*	10/27/2011	11/3/2021	500	XS0686701953/US62987BAA08
Angola (Northern Lights III)*	8/16/2012	8/16/2019	1000	XS0814512223
Zambia*	9/13/2012	9/20/2022	750	XS0828779594/US988895AA69
Tanzania (floating rate note)*	2/27/2013	2/27/2020	600	XS0896119897
Rwanda*	4/25/2013	5/2/2023	400	XS0925613217/US78347YAA10
Nigeria	7/12/2013	7/12/2018	850	XS0944707651/US65412ACE01
Nigeria	7/12/2013	7/12/2023	500	XS0944707222/US65412ACD28
Ghana	8/7/2013	8/7/2023	1000	XS0956935398/US374422AB97
Mozambique (Ematum)*	9/11/2013	9/11/2020	500	XS0969351450
Gabon	12/12/2013	12/12/2024	1500	XS1003557870/US362420AB78
Zambia	4/14/2014	4/14/2024	1000	XS1056386714/US988895AE81
Kenya*	6/24/2014	6/24/2019	500	XS1028951850/US491798AF18
Kenya	6/24/2014	6/24/2024	1500	XS1028952403/US491798AE43
Côte d'Ivoire*	7/23/2014	7/23/2024	750	XS1089413089
Senegal	7/30/2014	7/30/2024	500	XS1090161875/US81720TAB17
Ghana	9/11/2014	1/18/2026	1000	XS1108847531/US374422AC70
Ethiopia*	12/11/2014	12/11/2024	1000	XS1151974877/US29766LAA44
Côte d'Ivoire	3/3/2015	3/3/2028	1000	XS1196517434
Gabon	6/16/2015	6/16/2025	500	XS1245960684
Zambia	7/30/2015	7/30/2027	1250	XS1267081575/US988895AF56
Ghana	10/14/2015	10/14/2030	1000	XS1297557412/US374422AD53
Namibia	10/29/2015	10/29/2025	750	XS1311099540/US62987BAB80
Angola	11/12/2015	11/12/2025	1500	XS1318576086/US035198AA89
Cameroon*	11/19/2015	11/19/2025	750	XS1313779081/US133653AA31
Mozambique	4/16/2016	1/18/2023	726.5	XS1391003446
Ghana	9/15/2016	9/15/2022	750	XS1470699957

Source: Thomson Reuters Datastream; Eurobond prospectus documents.

Notes: Bonds marked with * are those with longest available yield series per country and are included in the samples of Tables 3 and Table 4.

Table A.2
Global and country variable definitions and sources.

Variable	Definition	Source
SSA Eurobond yield (YIELD)	SSA Eurobond yield to maturity (monthly percentage, averaged from daily data)	Thomson Reuters Datastream
Bloomberg commodity index (BCOM)	Bloomberg spot index composed of energy, grain, industrial metal, precious metal, soft (sugar, coffee, cotton) and livestock prices (monthly, averaged from daily data)	Thomson Reuters Datastream

Table A.2 (Continued)

Variable	Definition	Source
VIX	Chicago Board Options Exchange (CBOE) volatility index, based on S&P 500 index option prices (monthly, averaged from daily data)	Thomson Reuters Datastream
10-year US Treasury bond yields (US10TB)	10 year US Treasury benchmark bond yield to maturity (monthly percentage, averaged from daily data)	Thomson Reuters Datastream
Current account balance to GDP (CABAL)	Ratio of current account balance to GDP (monthly, linearly interpolated from annual data)	IMF World Economic Outlook
Government gross debt to GDP (DEBT)	Ratio of general government gross debt to GDP (monthly, linearly interpolated from annual data)	IMF World Economic Outlook
Government fiscal balance to GDP (FISCBAL)	Ratio of general government primary net lending/borrowing to GDP (monthly, linearly interpolated from annual data)	IMF World Economic Outlook
Foreign reserves to GDP (RES)	Ratio of international reserves (excluding gold) to GDP (monthly, with GDP linearly interpolated from annual data)	IMF International Financial Statistics
GDP growth (GDPGR)	Change in GDP, expressed in current US\$ billions (month-on-month percentage change, with GDP linearly interpolated from annual data)	IMF World Economic Outlook
Exchange rate change (XRTCH)	Change in exchange rate, expressed as local currency units per US\$. Increase implies exchange rate depreciation (month-on-month percentage change)	Thomson Reuters Datastream
Inflation (INFL)	Change in seasonally-adjusted consumer price index (CPI) (month-on-month percentage change)	Thomson Reuters Datastream

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